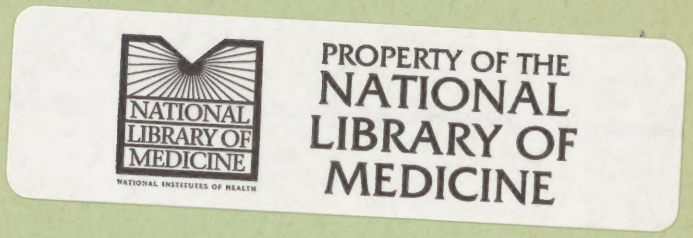
Research Reports

DEVELOPMENT OF RATION UNITS FOR THE AIR FORCE EMERGENCY RATION

Interim Report No. 1

On Project 7-84-07-02

Quartermaster food and container institute for the armed forces



OQMG, MILITARY PLANNING DIVISION, RESEARCH AND DEVELOPMENT BRANCH

QM FOOD AND CONTAINER INSTITUTE FOR THE ARMED FORCES

Interim Report No. 1

on Project 7-84-07-02

RATION, AIR FORCE, EMERGENCY

DEVELOPMENT OF RATION UNITS FOR THE AIR FORCE EMERGENCY RATION*

by

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* Project No. 7-84-07-02. The work phase, Development of Ration Units, reviewed in this Interim Report has led to the preparation of a Purchase Description (11 October 1948) permitting the procurement of the ration under the title, Food Packet, Individual, Survival, SA-1.

INTRODUCTION

This Interim Report covers the activities of the Food Development Division and the Military Research Office in bringing the new Air Force Emergency Ration, officially designated "Food Packet, Individual, Survival, SA-1," to its present state of development.

Twenty types of food bars were prepared by the various commodity development branches for consideration as components of the Air Force Emergency Ration. The requirements of this ration have been listed in a preceding report (1); these are briefly stated below insofar as they are related to the development phase of the project:

(a) Total caloric intake: 1800 calories per man per day.

(b) Ratio of protein-to-fat-to-carbohydrate: approximately 2:3:14. (Other nutrients as naturally supplied by the food ingredients.)

(c) Food composition: proteins of highest nutritional value, digestible and stable fats, and available carbohydrates.

(d) Acceptability: palatable when consumed under temperature extremes and with a limited water supply.

IDENTITY, ACCEPTABILITY, AND COMPOSITION OF THE RATION BARS

Of the twenty food bars prepared, sixteen were considered sufficiently promising to justify holding tests to determine keeping quality. These bars are listed in Table I by laboratory number and identified by a descriptive phrase. The results of the organoleptic findings are also included in the compilation. The weight of each individual bar approximated one ounce.

TABLE I

ACCEPTABILITY RATINGS OF 16 RATION BARS CONSIDERED MOST PROMISING

Laboratory No.	Identity	Food Development Branch	Organoleptic Observations			
			Color	Texture	Taste Acceptance	
					Mean Rating (On 1 to 10 scale)	% of Subjects Rating in Acceptable Range
FD 1	Oatmeal	Cereal & Baked Prods.	Light yellow	Sl. crumbly	7.2	88
FD 2	Cheese	" " "	Light brown	Crumbly	7.9	100
FD 3	Chocolate malted milk	" " "	Brown	Sl. crumbly	8.1	100
FD 4	Vanilla	" " "	Light yellow	Sl. crumbly	7.8	94
FD 5	Coconut	" " "	Tan	Firm	7.1	73
FD 6	Medium date, medium apricot, wheat and rice (pasteurized)	Fruit & Veg. Prods.	Light brown and white marbleized	Firm	6.5	67
FD 7	High date, low apricot wheat and rice (pasteurized)	" " "	Brown and white marbleized	Firm	7.2	81
FD 8	Low date, high apricot wheat and rice (pasteurized)	" " "	Orange and white marbleized	Sl. crumbly	5.8	50
FD 9	Low date, high apricot rice (pasteurized)	" " "	Orange and white marbleized	Sl. crumbly	6.2	62
FD 10	Medium date, medium apricot, wheat (pasteurized)	" " "	Brown and white marbleized	Firm	6.4	67
FD 11	Cheese and cracker	Dairy Products	Light buff	Crumbly	8.4	100
FD 12	Peanut butter and cracker	" "	Medium tan	Crumbly	7.4	88
FD 13	Modified sweetmeat	" "	Tan	Firm - fudge	7.2	81
FD 14	Peanut butter and jam	Dairy Products	Brown with dark and light colored particles	Sl. crumbly	8.3	100
FD 15	Almond	General Products	Brown	Very crumbly	8.2	100
FD 16	Granulex chocolate	General Products	Brown	Firm	8.6	100

It will be noted that there was considerable variety in color and texture of the items. With the possible exception of sample FD-8* (low date, high apricot, wheat and rice), all bars received satisfactory taste acceptance ratings. The six samples rating highest were, in order of preference, FD-16 (granulex chocolate), FD-11 (cheese and cracker), FD-14 (peanut butter and jam), FD-15 (almond), FD-3 (chocolate malted milk), and FD-2 (cheese); these samples were considered acceptable by all test subjects.

In the Appendix to this report are given the formula, processing procedures, and nutritional evaluation of each ration bar. Calculations of nutrient composition were based upon data in the literature (2-5). In Table II are summarized the nutritional evaluations, and in Table III is presented a comparison of the essential amino acid composition of the proteins in the Emergency Ration bars with that of egg albumen. The latter values were based upon data compiled by Block and Bolling (6) and subsequently corrected (7) when results of the more accurate microbiological assays became available.

It will be noted from the values listed in Table II that considerable variations existed in the ratio of protein-to-fat-to-carbohydrate, and that all ration bars were low in carbohydrate content according to the requirements set forth in an early section of this report. However, these points of deviation are not considered to be of great concern since (a) the ration is intended to contain a variety of bars and differences in ratio of foodstuffs will be balanced and compensated, and (b) the proper concentration of carbohydrate in the ration is easily obtainable by the

* In the Appendix to this report, it is pointed out that mechanical difficulties in preparing this item were responsible for scorched and caramelized surfaces on a very large number of the bars.

TABLE II

NUTRITIONAL EVALUATION OF RATION BARS

Laboratory No.	Identity	Proximate Composition, per 100 gm.					Ratio of a:b:c	Caloric Contributions		
		Protein (a)	Fat (b)	Carbohydrates (c)	Crude Fiber	Caloric Value		Protein	Fat	Carbohydrates
		gm.	gm.	gm.	gm.	cal.		Percent of Total		
FD 1	Oatmeal	16.9	32.0	43.6	0.1	530	2:3.8:5.2	12.8	54.5	32.7
FD 2	Cheese	16.2	33.2	42.8	0.1	533	2:4.0:5.2	12.1	55.8	32.1
FD 3	Chocolate malted milk	15.3	31.0	46.0	0.1	521	2:4.0:6.0	11.5	53.2	35.3
FD 4	Vanilla	17.0	32.0	43.5	0.1	530	2:3.8:5.2	12.7	54.5	32.8
FD 5	Coconut	16.9	32.6	42.8	0.1	531	2:3.8:5.0	12.7	55.2	32.1
FD 6	Medium date, medium apricot, wheat and rice (pasteurized)	11.4	15.5	53.0	1.0	396	2:2.8:9.4	11.4	35.2	53.4
FD 7	High date, low apricot wheat and rice (pasteurized)	11.2	15.5	54.0	1.2	402	2:2.8:9.6	11.2	34.7	54.1
FD 8	Low date, high apricot wheat and rice (pasteurized)	12.0	15.7	51.5	0.2	395	2:2.6:8.6	12.0	36.0	52.0
FD 9	Low date, high apricot rice (pasteurized)	11.6	15.7	51.5	0.2	394	2:2.8:8.8	11.8	36.2	52.0
FD 10	Medium date, medium apricot, wheat (pasteurized)	12.1	15.5	52.3	0.8	396	2:2.6:8.8	12.0	35.0	53.0
FD 11	Cheese and cracker	21.7	17.1	52.4	0.1	450	2:1.6:4.8	19.4	33.9	46.7
FD 12	Peanut butter & cracker	19.9	21.3	51.0	0.8	475	2:2.2:2.5	16.8	40.4	42.8
FD 13	Modified sweetmeat	19.3	21.4	52.1	0.4	480	2:2.2:5.4	16.1	40.2	43.7
FD 14	Peanut butter and jam	14.0	15.4	63.5	0.6	448	2:2.2:9.0	12.5	31.0	56.5
FD 15	Almond	12.5	37.8	45.3	2.0	572	2:6.2:7.4	8.6	59.8	31.6
FD 16	Granulex chocolate	13.5	25.2	56.4	0.0	515	2:3.8:8.4	10.6	45.0	44.4

replacement of some of the bars with an all-carbohydrate type of candy.

It is highly desirable, from the standpoint of procurement, to have available a number of items which, in various combinations or with slight modifications will satisfy different objectives. The present series of ration bars are sufficiently varied to accomplish such a purpose.

Several projects in the Institute are concerned with emergency rations whose requirements may differ from those listed in the present report. The variations in the composition of the bars permit some flexibility in drawing up rations for these other purposes. For example, it was pointed out in a conference (8), bearing on a proposal to initiate a research and development project on a Life Boat Ration, that a modification of Army Air Force Emergency Ration should prove satisfactory. To meet the objectives of the Life Boat Ration, keeping in mind:

(a) the potential users,

(b) the short period during which it would be consumed,

(c) the conditions under which it would be used, and

(d) the available water supply,

palatable, readily utilizable food products of high caloric density should be adequate; on the other hand, nutrient contributions other than calories, derived mainly from carbohydrate, may be largely or entirely neglected. Slight modifications of certain of the formulations may be employed to attain these objectives.

Differences in the composition of the Air Force Emergency Ration bars permit, by selection of the items, formulation of rations in which the ratio of protein-to-fat-to-carbohydrate differs from that set forth earlier in this report as one of the basic requirements. It should be recognized that the proposed ratio of the foodstuffs is not permanently established

and may be subjected to change as a result of further studies. Thus, Dr. Schwimmer (9) has found that when the dietary intake is restricted to 900 calories of food and 800 ml. of water per man per day, the ratio of protein-to-fat-to-carbohydrate should be 30:30:40, or 2:2:2.7. The same investigator has recommended that 1800 calories be furnished in areas of extreme cold, with a ratio of protein-to-fat-to-carbohydrate approximating 15:30:55, or 2:4:7.3. Whereas modifications of the presently available items would be required to meet his specifications for the 900 calorie ration, certain of the current ration bars can be composited in preparing the higher calorie ration recommended by Dr. Schwimmer.

Another possible advantage, worthy of consideration, is the low crude fiber contain of the ration bars, viz., FD-1, 2, 3, 4, 5, 8, 9, 11, and 16. The problem of defecation in localities of extreme cold has been emphasized in reports covering maneuvers when the individual has no access to a heated shelter. Attempts to develop food items in rations which reduce the frequency of defecation seem justified. Insofar as crude fiber contributes bulk to the stools and thereby promotes elimination, rations low in such components are preferred.

Should it subsequently become necessary to develop bars intended to be the sole source of calories over extended periods of time, as in the case of a civilian survival ration, the present items would be satisfactory when fortified with the essential vitamins and minerals. Stabilization of the ordinarily labile nutrients in the fortified bars would not present an insurmountable problem. Furthermore, in a dietary consisting of the current ration bars (furnishing 1800 calories) the protein contribution should be adequate both quantitatively (approximately 50 grams per day) and qualitatively (see Table III).

TABLE III

COMPARISON OF THE ESSENTIAL AMINO ACID COMPOSITION OF THE PROTEINS IN SURVIVAL RATION BARS WITH THAT OF EGG ALBUMEN

SAMPLE	Protein Content	ESSENTIAL AMINO ACID CONTENT OF PROTEIN (2) %												TOTAL	"Non-Essential" (4) Amino Acid Content
		Arginine	Histidine	Lysine	Tryptophane	Phenylalanine	Tyrosine	Methionine	Cystine	Threonine	Leucine	Isoleucine	Valine		
Egg White, dried (1)	75.0	5.8	2.2	6.5	1.6	5.5	4.8	4.4	2.3	3.8 (3)	9.4 (3)	7.1 (3)	7.3	60.7	55.3
Bar, FD-1	16.9	5.9	2.2	5.8	1.4	5.8	4.5	3.5	2.2	3.9	8.6	6.4	6.3	56.5	59.5
Bar, FD-2	16.2	5.5	2.3	6.1	1.4	5.8	4.8	3.7	2.1	4.0	9.2	6.7	6.8	58.4	57.6
Bar, FD-3	15.3	5.6	2.2	6.0	1.5	5.8	4.6	3.7	2.2	3.8	9.2	6.8	6.8	58.2	57.8
Bar, FD-4	17.0	5.9	2.2	5.8	1.4	5.8	4.5	3.5	2.2	3.9	8.6	6.4	6.3	56.5	59.5
Bar, FD-5	16.9	5.9	2.2	5.8	1.4	5.7	4.5	3.5	2.2	3.9	8.6	6.4	6.3	56.4	59.6
Bar, FD-6	11.4	5.9	2.1	5.8	1.6	5.3	4.7	3.9	2.1	4.0	9.5	6.5	6.9	58.3	57.7
Bar, FD-7	11.2	5.9	2.1	5.8	1.6	5.4	4.7	3.9	2.1	4.1	9.5	6.5	6.9	58.5	57.7
Bar, FD-8	12.0	5.9	2.0	5.7	1.7	5.3	4.7	3.8	2.1	4.0	9.6	6.4	6.8	58.0	58.0
Bar, FD-9	11.6	6.1	2.0	5.9	1.7	5.4	4.9	3.9	2.2	4.0	9.7	6.5	6.9	59.2	56.8
Bar, FD-10	12.1	5.5	2.1	5.4	1.6	5.2	4.4	3.8	2.0	4.0	9.3	6.2	6.7	56.2	59.8
Bar, FD-11	21.7	4.6	2.6	6.2	1.3	5.6	5.6	3.3	1.2	3.7	9.4	6.2	6.4	56.1	59.9
Bar, FD-12	19.9	7.3	2.2	3.9	1.2	5.5	4.4	2.3	1.9	2.5	7.9	4.4	6.9	50.4	65.6
Bar, FD-13	19.3	6.7	2.3	5.7	1.4	5.5	4.9	3.2	1.8	3.2	9.0	3.0	7.7	54.4	61.6
Bar, FD-14	14.0	7.9	2.2	4.2	1.2	5.4	4.5	2.4	1.9	2.4	7.9	4.5	7.5	52.0	64.0
Bar, FD-15	12.5	8.9	2.2	3.9	1.1	5.5	4.4	1.7	1.7	2.2	7.1	3.7	7.2	49.6	66.4
Bar, FD-16	13.5	5.3	2.4	6.9	1.6	5.6	4.9	3.7	1.7	4.1	9.9	7.4	7.4	60.8	55.2

(1) This sample of egg albumen was employed in the preparation of the bars

(2) Calculated to 16% nitrogen content

(3) Based on values for egg albumen

(4) 116=Total essential amino acids

THE PROTEIN COMPONENT IN THE EMERGENCY RATION BAR

The composition of the protein in an emergency ration bar intended as the sole source of nutrients for periods extending beyond 4 days is of paramount importance. Basic research has demonstrated that the inclusion of a small amount of a protein of high biological value in a ration supplying the minimal caloric requirement reduces the urinary excretion of urea and thereby the obligatory urine volume. Application of this finding to survival feeding makes it possible to minimize the dehydration resulting from a limited fluid intake. When the problem is one of subsistence for a more extended period, viz., 30 days on an emergency ration, the inclusion of protein with a high biological value in the ration spares tissue protein catabolism to a maximum. An organism on such a ration is less susceptible to fatigue following exertion, can more readily withstand shock following trauma, and is generally more resistant to disease. The data in Table III demonstrate that the essential amino acid content of the bars as a whole does not differ too greatly from that of egg albumen, a protein complex of recognized high biological value and employed as one of the ingredients in all the formulas (see Appendix). In certain bars, the concentration of lysine, methionine, and isoleucine is low, but in a ration containing a variety of bars, these deficiencies are masked. Thus, in the preparation of 500 emergency rations consisting of 4 separate menus (requested by Captain Roth of the Aero Medical Laboratories, A.M.C., U.S.A.F.) to be used in the Alaskan field test, it was found that the essential amino acid compositions of the total protein in each ration, regardless of menu, closely simulated that of the proteins in egg albumen. In Table IV are listed the values for the individual amino acids in egg albumen and in each of the ration menus.

TABLE IV

PER CENT ESSENTIAL AMINO ACID CONTENT OF PROTEIN OF
AIR FORCE EMERGENCY RATIONS COMPARED WITH EGG WHITE PROTEIN*

AMINO ACID	EGG WHITE	MENU I	MENU II	MENU III	MENU IV
Arginine	5.8	5.9	5.8	5.8	5.8
Histidine	2.2	2.2	2.2	2.2	2.2
Lysine	6.5	5.7	5.7	5.7	5.7
Tryptophane	1.6	1.4	1.5	1.5	1.5
Phenylalanine	5.5	5.6	5.6	5.5	5.6
Tyrosine	4.8	4.7	4.7	4.7	4.7
Methionine	4.4	3.4	3.5	3.6	3.5
Cystine	2.3	1.9	2.0	2.0	2.0
Threonine	3.8	3.7	3.8	3.8	3.8
Leucine	9.4	8.9	9.1	9.2	9.1
Isoleucine	7.1	6.2	6.3	6.3	6.3
Valine	7.3	6.8	6.6	6.8	6.6

* Calculated to 16 percent nitrogen content.

FORMULATION OF MENUS FOR FIELD TESTS IN AREAS OF EXTREME COLD

In Table V are presented calculations of the quantities of foodstuffs in each test ration. It will be noted that supplementation of the eleven food bars with two and one-half 2 ounce starch jelly bars and three 6 gram sugar blocks yielded the desired ratio of protein-to-fat-to-carbohydrate. In Table VI are listed the bars selected in formulating each of the menus. Two sets of emergency ration bars, identified as "old" and "new", were available for this purpose. Whereas the ingredients used in both sets were identical, methods of manufacture differed.

The first formulation, designated "old" in Table VI, by the Cereal and Baked Products Branch simulated that employed in making pound cake. The baked products contained approximately 15 percent moisture and were dried to approximately 6 percent moisture content. During the dehydration, however, desirable flavor components were volatilized, and the texture of the final bar was unsatisfactory. In the subsequent formulation, identified as "new" in Table VI, the same ingredients were composited in a cookie dough, then baked to a 6 percent moisture content after which the cookies were ground and pressed into bars. Taste and texture of the "new" bar were thus improved.

The dates and apricots in the "old" formulation by the Fruit and Vegetable Products Branch were ground in such a manner that the fruits were obtained as pastes; the compressed bars were heated under uncontrolled conditions to eliminate insect contamination. During the latter operation temperatures of from 180° to 200° F. were attained and this was responsible for caramelization and other undesirable changes reflected in lower taste acceptance. In the "new" formulation, the fruits were chopped into small

TABLE V

NUTRITIONAL EVALUATION OF AIR FORCE EMERGENCY RATION MENUS USED IN A FIELD TEST AT LADD FIELD, ALASKA, UNDER THE SUPERVISION OF THE AERO-MEDICAL LABORATORY (A.M.C., U.S.A.F.)

CRITERION	MENU I		MENU II		MENU III		MENU IV	
COMPOSITION	1.*	2.*	1.*	2.*	1.*	2.*	1.*	2.*
% Protein	15.8	10.5	15.5	10.3	14.8	9.8	14.6	9.7
% Fat	24.6	16.3	23.8	15.7	21.8	14.4	23.5	15.5
% Carbohydrate	49.7	63.8	48.2	62.6	50.0	63.8	51.0	64.6
Calories	1514	2094	1466	2046	1423	2004	1521	2101
RATIO								
Protein	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Fat	3.1	3.1	3.1	3.1	2.9	2.9	3.2	3.2
Carbohydrate	6.3	12.2	6.2	12.2	6.7	13.0	7.0	13.3

* Column 1 - Ration consisting of 11 food bars. (1-oz. bars)

* Column 2 - Ration consisting of 11 food bars and 2½ 2-oz. starch-jelly bars and 3 6-gm. blocks of sugar

Only those rations listed in Column 2 were subjected to the field test. In addition, one bouillon cube, one soluble coffee packet, one soluble tea packet, six pieces of candy coated chewing gum, and a plastic bag were furnished with each ration. The entire ensemble was packaged in a tin can, 37.5 cubic inches (6-5/8 x 4-1/8 x 1-3/8), and the gross weight was 641 gm. (22.6 oz.) of which 472 gm. were the food items employed in the above tabulation. The can alone weighed 144 gm.

TABLE VI

EMERGENCY RATION BARS SELECTED FOR MENUS USED IN A FIELD TEST AT LADD FIELD, ALASKA
UNDER THE SUPERVISION OF THE AERO-MEDICAL LABORATORY (A.M.C., U.S.A.F.)

Ration Bars						
Laboratory No.	Identity	Food Development Branch	Menu I	Menu II	Menu III	Menu IV
			Formulation of Ration Bars			
FD 1	Oatmeal	Cereal & Baked Prods.	New	Old	(New)	Old
FD 2	Cheese	" " "	"	"	"	"
FD 3	Chocolate malted milk	" " "	"	"		"
FD 4	Vanilla	" " "	"	"	"	"
FD 5	Coconut	" " "	"	"	"	"
FD 6	Medium date, medium apricot, wheat and rice (pasteurized)	Fruit & Veg. Prods.	New	Old	Old	
FD 7	High date, low apricot, wheat and rice (pasteurized)	" " "	"	(Old)	"	
FD 8	Low date, high apricot, wheat and rice (pasteurized)	" " "		Old	"	New
FD 9	Low date, high apricot, rice (pasteurized)	" " "		"	"	
FD 10	Medium date, medium apricot, wheat (pasteurized)	" " "		"		"
FD 11	Cheese and cracker	Dairy Products	New	Old	Old	(New)
FD 12	Peanut butter & cracker	" "	"	"	"	(New)
FD 13	Modified sweetmeat	" "	(New)			
FD 14	Peanut butter and jam	" "	"			New#
FD 15	Granulex chocolate	General Products	"		New	New#

* In several cases, where limited quantities of certain bars were available, it was necessary to add a number of bars of another type to complete the assembly of rations requested. These supplementary bars are designated by parentheses around the formulation employed. The bracket points to the bar supplied to a major extent.

\# In addition to the combinations indicated by brackets, each ration contained one more of each of these bars.

pieces, retaining thereby tissue integrity, and the temperature of processing was held for a period of 40 minutes at 150° to 170° F.

The objectives in submitting for field testing the menus listed in Table VI may be briefly stated:

(a) evaluation of the acceptability, utility, and physiological adequacy of the more promising emergency ration, and

(b) determination of whether the soldier in the field is as discriminatory as the developmental personnel in detecting differences in acceptability of the ration components.

In addition, an emergency ration was prepared for a field test at Camp Shilo, Manitoba, Canada under the supervision of the Medical Nutrition Laboratory (O.S.G.), Chicago. The components of this ration and other pertinent data are listed in Table VII.

PERTINENT STUDIES CONDUCTED OUTSIDE OF THE FOOD DEVELOPMENT DIVISION

Collaborative studies between members of the Food Development Division and the Subsistence Branch of the Container Development Division have been under way and have led to the development of a calcium pectinate coating of the ration bars. The importance of this method of packaging cannot be overemphasized; (a) the coating is edible and need not be removed prior to the consumption of the food, (b) it enhances the physical stability of the bars, preventing breakage, and (c) it contributes negligible weight and volume to the ration. The development of a mechanical means for applying the coating and the assurance that no bacterial propagation or toxin formation occurs during the drying of the film requires further investigation. Progress leading to improved methods for packaging the emergency ration will undoubtedly be

TABLE VII

COMPOSITION OF THE AIR FORCE EMERGENCY RATION USED IN A FIELD TEST AT CAMP SHILO, MANITOBA, CANADA, UNDER THE SUPERVISION OF THE MEDICAL NUTRITION LABORATORY (O.S.G.), CHICAGO, ILLINOIS

Ration Component*			No. of components in ration	Weight of components
Lab. No.	Identity	Food Development Branch		oz.
FD 1	Oatmeal bar	Cereal & Baked Prods.	1	1
FD 3	Chocolate malted milk bar	" " "	1	1
FD 4	Vanilla bar	" " "	1	1
FD 5	Coconut bar	" " "	1	1
FD 6	Medium date, medium apricot, wheat and rice (pasteurized) bar	Fruit & Veg. Prods.	1	1
FD 7	High date, low apricot wheat and rice (pasteurized) bar	" " "	1	1
FD 11	Cheese and cracker bar	Dairy Products	1	1
FD 13	Modified sweetmeat bar	" "	1	1
FD 15	Almond bar	General Products	1	1
FD 16	Granulex chocolate bar	" "	1	1
---	Starch jelly bar	Commercial product	2	4
---	Bouillon powder	" "	1	0.4
---	Soluble coffee product	" "	1	0.2
---	Soluble tea product	" "	1	0.02
---	Blocks of sugar	" "	3	0.5
---	Candy coated chewing gum	" "	3	0.4
Total weight of food components				15.5
Ratio of protein:fat:carbohydrate = 2:3.4:12.4				

* The entire ensemble, including one package of nine cigarettes, a book of ten matches and a plastic bag, was packaged in a tin can, 37.5 cubic inches (6-5/8 x 4-1/8 x 1-3/8), and the gross weight was 600 gm. (21 oz.); the can alone weighed 144 gm.

reviewed by the work phase leader in the Subsistence Branch of the Container Laboratories.

Collaborative studies between the Food Development and Food Research Divisions designed to evaluate the stability of the ration bars (11) have also been in progress. The samples were stored under a variety of holding conditions; viz., atmosphere, temperature, and alternate freezing and thawing. Deteriorative changes were followed by a variety of objective tests, and objective consumer acceptance studies were also conducted. A summary of the findings will undoubtedly be prepared by the work phase leader in the Research Division.

The results of the field test of the survival ration under the supervision of the Aero-Medical Laboratory (A.M.C., U.S.A.F.) have already been summarized (12, 13). These reports deal with the overall acceptability of the ration and with the physiological response of the test subjects subsisting on the ration. The observations of the representative of the Quartermaster Food and Container Institute for the Armed Forces at the field test will be summarized in a future report. The latter will deal with a critical acceptance evaluation of the ration components. Observations made by a representative of the Institute at the field test of the survival ration under the supervision of the Medical Nutrition Laboratory (O.S.G.) have been summarized (14). This report deals mainly with the acceptability of the ration items. Certain clinical observations are also included. These were taken from the preliminary report to the Surgeon General, submitted by Dr. Johnson of the Medical Nutrition Laboratory. The full report from the latter laboratory has as yet not been prepared.

In the preparation of the Purchase Description (15) permitting the procurement of the ration from industry, preference was shown for a mixed milk

protein supplement over the spray-dried egg albumen used in the developmental studies reviewed in this report. This decision was based upon opinions expressed by investigators in the research program sponsored by the Committee on Food Research and by members of the Scientific Liaison and Advisory Board of the Quartermaster Food and Container Institute. The individuals consulted in arriving at this decision were Dr. Allison of Rutgers University, Dr. Schwimmer of the New York Medical College, Dr. Block of the New York Medical College, Dr. Conquest of Armour and Company, Dr. Pollack of Mount Sinai Hospital of New York City, and Dr. Chow of The Squibb Institute for Medical Research. Records of the more important discussions are available (10, 16, 17). Approval for inclusion in the ration formulation of the mixed milk protein as the protein supplement of high biological value was obtained from Dr. Johnson of the Medical Nutrition Laboratory of the Office of the Surgeon General (18).

The preceding summation should suffice to indicate that many groups are interested in the development of a satisfactory survival ration for the Air Force. Review of the references cited will emphasize that conflicting views still exist as to the optimal total caloric contribution, the level of protein, the ratio of protein to fat to carbohydrate, and the character of the protein component in the ration. Before further developmental work is justified, it will be essential to resolve these points of disagreement. Furthermore, the reports, still lacking, are required to permit all interested groups to evaluate the overall progress to date. Continuance of developmental research on the ration components, without advantage being taken of all results obtained thus far, is contra-indicated.

SUMMARY

The studies leading to the development of sixteen food bars for possible inclusion in the Air Force Emergency Ration were reviewed. In the Appendix to this report are listed the formulation, processing, and nutritional composition of the individual bars. By a proper selection of bars and by the addition of an all-carbohydrate confection (starch jelly bar), it was possible to design a ration meeting the requirements specified at the start of the developmental studies. The essential amino acid composition of the protein in the ration closely approximated that of egg albumen, a protein complex of recognized high biological value. Based upon (a) the observation made in field tests of various menus, (b) the laboratory findings in studies of the stability of the individual bars, and (c) the recommendations of members of the Scientific Liaison and Advisory Board of the Institute, a Purchase Description was prepared to permit procurement of the ration. Further developmental work on the ration components is being held in abeyance until reports from the many groups concerned with the development and utilization of the ration have been received and evaluated.

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APPENDIX

OATMEAL BAR

FD-1

FORMULA:

Ingredient	Percent*
Flour, wheat	20.4
Soya grits	6.3
Rice flour	3.2
Oatmeal	1.5
Shortening	23.6
Sugar	18.9
Eggs, whole	7.8
Egg albumen	7.8
Salt	.5
Vanilla	.1
Water	9.9

* 100 parts of the original mix were reduced to 94 parts in processing

PROCESSING:

Sugar, shortening, whole eggs, and water were creamed. The balance of the ingredients were added and mixed until thoroughly incorporated. The mixed dough was divided into 4 lb. portions and chilled to 40° F. The chilled dough was then rolled to a thickness of 1/4 inch, placed on a baking sheet and baked in a 350° F. oven for 30 minutes. After cooling, the baked sheet was chopped in a Buffalo Silent Cutter and pressed. These bars were pressed with some difficulty due to stickiness and crumbliness. This difficulty was somewhat obviated by scraping and cleaning the dies after each pressing.

NUTRITIONAL EVALUATION

Composition	Per 100 grams	Per Ounce	Ratio	Percent Calories
Total Solids	93.7	26.6		
Protein	16.9	4.8	1.0	12.8
Fat	32.0	9.1	1.9	54.5
Carbohydrates*	43.6	12.4	2.6	32.7
Crude fiber	.1	.3		
Ash	1.1	.03		
Caloric Value	530	150.8		

* Other than crude fiber

CHEESE BAR

FD-2

FORMULA:

Ingredient	Percent*
Flour, wheat	22.2
Rice flour	3.2
Shortening	23.7
Sugar	19.0
Eggs, whole	7.9
Egg albumen	7.9
Salt	.5
Vanilla	.2
Cheese	6.3
Water	9.1

* 100 parts of the original mix were reduced to 94 parts in processing.

PROCESSING:

Sugar, shortening, whole eggs, and water were creamed. The remainder of the ingredients was added and mixed until thoroughly incorporated. The mixed dough was divided into 4 lb. portions and chilled to 40° F. The chilled dough was then rolled to a thickness of 1/4 inch, placed on a baking sheet and baked in a 350° F. oven for 30 minutes. After cooling, the baked sheet was chopped in a Buffalo Silent Cutter and pressed. This bar displayed a light amount of fat leakage during compression. The least amount of fat leakage and least difficulty with respect to sticking to the compression dies was obtained by one punch at an estimated pressure of 1000 lbs. per square inch. The ground material was excessively dark in color, suggesting the possibility that the mix had been slightly overbaked.

NUTRITIONAL EVALUATION

Composition	Per 100 grams	Per Ounce	Ratio	Percent Calories
Total Solids	93.8	26.6		
Protein	16.2	4.2	1.0	12.1
Fat	33.2	9.4	2.0	55.8
Carbohydrate*	42.8	12.1	2.6	32.1
Crude fiber	.1	.03		
Ash	1.5	.5		
Caloric Value	533	151.4		

* Other than crude fiber

CHOCOLATE MALTED MILK

FD-3

FORMULA:

Ingredient	Percent*
Flour, wheat	20.6
Rice flour	3.2
Shortening	23.0
Sugar	19.0
Eggs, whole	7.9
Egg albumen	7.9
Salt	.5
Vanilla	.5
Malted Milk	6.5
Chocolate	1.6
Water	9.6

* 100 parts of the original mix were reduced to 94 parts in processing.

PROCESSING:

Sugar, shortening, whole eggs, and water were creamed. The remainder of the ingredients was added and mixed until thoroughly incorporated. The mixed dough was divided into 4 lb. portions and chilled to 40° F. The chilled dough was then rolled to a thickness of 1/4 inch, placed on a baking sheet and baked in a 350° F. oven for 30 minutes. After cooling, the baked sheet was chopped in a Buffalo Silent Cutter and pressed. These bars were pressed with some difficulty due to stickiness and crumbliness. This difficulty was somewhat obviated by scraping and cleaning the dies after each pressing.

NUTRITIONAL EVALUATION

Composition	Per 100 grams	Per Ounce	Ratio	Percent Calories
Total Solids	93.7	26.6		
Protein	15.3	4.3	1.0	11.5
Fat	31.0	8.8	2.0	53.2
Carbohydrate*	46.0	13.1	3.0	35.3
Ash	1.3	.4		
Crude fiber	.1	.03		
Calories	521	148.8		

* Other than crude fiber.

VANILLA BAR

FD-4

FORMULA:

Ingredient	Percent*
Flour, wheat	21.9
Soya grits	6.3
Rice flour	3.2
Shortening	23.4
Sugar	18.8
Eggs, whole	7.8
Egg albumen	7.8
Salt	.5
Vanilla	.2
Water	10.1

* 100 parts of the original mix were reduced to 94 parts in processing.

PROCESSING:

Sugar, shortening, whole eggs, and water were creamed. The remainder of the ingredients was added and mixed until thoroughly incorporated. The mixed dough was divided into 4 lb. portions and chilled to 40° F. The chilled dough was then rolled to a thickness of 1/4 inch, placed on a baking sheet and baked in a 350° F. oven for 30 minutes. After cooling, the baked sheet was chopped in a Buffalo Silent Cutter and pressed. These bars were pressed with some difficulty due to stickiness and crumbliness. This difficulty was somewhat obviated by scraping and cleaning the dies after each pressing.

NUTRITIONAL EVALUATION

Composition	Per 100 grams	Per Ounce	Ratio	Percent Calories
Total Solids	93.8	26.5		
Protein	17.0	4.8	1.0	12.7
Fat	32.0	9.1	1.9	54.5
Carbohydrate*	43.5	12.3	2.6	32.8
Ash	1.2	.3		
Crude Fiber	.1	.03		
Calories	530	150.5		

* Other than crude fiber.

COCOANUT BAR

FD-5

FORMULA:

Ingredient	Percent*
Flour, wheat	20.4
Soya grits	6.3
Rice flour	3.2
Cocoanut	1.5
Shortening	23.4
Sugar	18.8
Eggs, whole	7.8
Egg albumen	7.8
Salt	.5
Vanilla	.2
Water	10.1

* 100 parts of the original mix were reduced to 94 parts in processing.

PROCESSING:

Sugar, shortening, whole eggs, and water were creamed. The remainder of the ingredients was added and mixed until thoroughly incorporated. The mixed dough was divided into 4 lb. portions and chilled to 40° F. The chilled dough was then rolled to a thickness of 1/4 inch, placed on a baking sheet and baked in a 350° F. oven for 30 minutes. After cooling, the baked sheet was chopped in a Buffalo Silent Cutter and pressed. These bars were pressed with some difficulty due to stickiness and crumbliness. This difficulty was somewhat obviated by scraping and cleaning the dies after each pressing.

NUTRITIONAL EVALUATION

Composition	Per 100 grams	Per Ounce	Ratio	Percent Calories
Total Solids	93.7	26.6		
Protein	16.9	4.8	1.0	12.7
Fat	32.6	9.3	1.9	55.2
Carbohydrate*	42.8	12.1	2.5	32.1
Ash	1.3	.4		
Crude fiber	.1	.03		
Calories	531	151.2		

* Other than crude fiber.

MEDIUM DATE, MEDIUM APRICOT, WHEAT AND RICE

FD-6

FORMULA:

Ingredient	Percent*
Dates, pitted	30
Apricots, evap.	30
Wheat, puffed	5
Rice, puffed	10
Egg, white dried	10
Fat (100 Hr.)	15

* Reduction in weight of original mix due to pasteurization not determined.

PROCESSING:

The fruits, cereals and fats were placed in the Buffalo Silent Cutter and chopped to a uniform texture, requiring approximately 3 minutes in the chopper. The chopped mixture was placed in a mechanical mixer, the powdered egg white added, and the material blended for a period of approximately 5 minutes. The prepared material was pressed into 1 oz. bars on a "Torque Punch Press", applying one punch of short duration at an estimated pressure of 1000 lbs. per square inch. The bars were mechanically wrapped and heat sealed in cellophane. Pasteurization was accomplished by immersing sealed 300 x 308 size cans, each containing 6 to 8 bars in boiling water for 40 minutes to a temperature of 150-170° F. in the bars. Cans were then cooled by water for 30 minutes to 85° F. in bars.

NUTRITIONAL EVALUATION

Composition	Per 100 grams	Per Ounce	Ratio	Percent Calories
Total Solids	82.6	23.3		
Protein	11.4	3.2	1.0	11.4
Fat	15.5	4.4	1.4	35.2
Carbohydrate*	53.0	15.0	4.7	53.4
Ash	1.6	.4		
Crude fiber	1.0	.3		
Calories	396	112.4		

* Other than crude fiber.

HIGH DATE, LOW APRICOT, WHEAT AND RICE

FD-7

FORMULA:

Ingredient	Percent*
Dates, pitted	40
Apricots, evap.,	20
Wheat, puffed	5
Rice, puffed	10
Egg white, dried	10
Fat (100 hr.)	15

* Reduction in weight of original mix due to pasteurization not determined.

PROCESSING:

The fruits, cereals and fats were placed in the Buffalo Silent Cutter and chopped to a uniform texture, requiring approximately 3 minutes in the chopper. The chopped mixture was placed in a mechanical mixer, the powdered egg white added, and the material blended for a period of approximately 5 minutes. The prepared material was pressed into 1 oz. bars on a "Torque Punch Press", applying one punch of short duration at an estimated pressure of 1000 lbs. per square inch. The bars were mechanically wrapped and heat sealed in cellophane. Pasteurization was accomplished by immersing sealed 300 x 308 size cans, each containing 6 to 8 bars in boiling water for 40 minutes at a temperature of 150-170° F. in the bars. Cans were then water cooled 30 minutes to 85° F. in bars.

NUTRITIONAL EVALUATION

Composition	Per 100 grams	Per Ounce	Ratio	Percent Calories
Total Solids	83.5	23.7		
Protein	11.2	3.2	1.0	11.2
Fat	15.5	4.4	1.4	34.7
Carbohydrate*	54.0	15.4	4.8	54.1
Ash	1.6	.4		
Crude fiber	1.2	.3		
Calories	402	114.0		

* Other than crude fiber.

LOW DATE, HIGH APRICOT, WHEAT AND RICE

FD-8

FORMULA:

Ingredient	Percent*
Dates, pitted	10
Apricots, evap.	50
Wheat, puffed	5
Rice, puffed	10
Egg white, dried	10
Fat (100 hr.)	15

* Reduction in weight of original mix due to pasteurization not determined.

PROCESSING:

The fruit, cereals, and fat were placed in the Buffalo Silent Cutter and chopped to a uniform texture, requiring approximately 3 minutes in the chopper. The chopped mixture was placed in a mechanical mixer, the powdered egg white added, and the material blended for a period of approximately 5 minutes. The prepared material was pressed into 1 oz. bars on a "Torque Punch Press", applying one punch of short duration at an estimated pressure of 1000 lbs. per square inch. This bar was the most difficult to compress, the spongy character of the chopped fruit yielding bars of extreme fragility. Approximately 70 percent of the compressed bars were "cripples" and had to be reworked. The bars were mechanically wrapped and heat sealed in cellophane, but the spongy fragile character of the passable bars produced wrapping difficulties which retarded production considerably. The retarded compression left the wrapped bars between the heated sealing plates longer than desirable, producing a scorched and caramelized surface on approximately 50 percent of the yield. Pasteurization was accomplished by immersing sealed 300 x 308 size cans, each containing 6 to 8 bars in boiling water for 40 minutes at a temperature of 150-170° F. in the bars. Cans were then water cooled 30 minutes to 85° F. in bars.

NUTRITIONAL EVALUATION

Composition	Per 100 grams	Per Ounce	Ratio	Percent Calories
Total Solids	80.8	23.0		
Protein	12.0	3.4	1.0	12.0
Fat	15.7	4.5	1.3	36.0
Carbohydrate*	51.5	14.6	4.3	52.0
Ash	1.4	.4		
Crude fiber	.2	.1		
Calories	395	112.5		

* Other than crude fiber.

LOW DATE, HIGH APRICOT, RICE

FD-9

FORMULA:

Ingredient	Percent*
Dates, pitted	10
Apricots, evap.	50
Rice, puffed	15
Egg white, dried	10
Fat (100 hr.)	15

* Reduction in weight of original mix due to pasteurization not determined.

PROCESSING:

The fruits, cereals and fats were placed in the Buffalo Silent Cutter and chopped to a uniform texture, requiring approximately 3 minutes in the chopper. The chopped mixture was placed in a mechanical mixer, the powdered egg white added, and the material blended for a period of approximately 5 minutes. The prepared material was pressed into 1 oz. bars on a "Torque Punch Press", applying one punch of short duration at an estimated pressure of 1000 lbs. per square inch. The bars were mechanically wrapped and heat sealed in cellophane. Pasteurization was accomplished by immersing sealed 300 x 308 size cans, each containing 6 to 8 bars in boiling water for 40 minutes at a temperature of 150-170° F. in the bars. Cans were then cooled 30 minutes to 85° F. in bars.

NUTRITIONAL EVALUATION

Composition	Per 100 grams	Per Ounce	Ratio	Percent Calories
Total Solids	80.8	23.0		
Protein	11.6	3.3	1.0	11.8
Fat	15.7	4.5	1.4	36.2
Carbohydrate*	51.5	14.6	4.4	52.0
Ash	1.8	.5		
Crude fiber	.2	.1		
Calories	394	112.1		

* Other than crude fiber.

MEDIUM DATE, MEDIUM APRICOT, WHEAT

FD-10

FORMULA:

Ingredient	Percent*
Dates, pitted	30
Apricots, evap.	30
Wheat, puffed	15
Egg white, dried	10
Fat (100 hr.)	15

* Reduction in weight of original mix due to pasteurization not determined.

PROCESSING:

The fruits, cereals, and fats were placed in the Buffalo Silent Cutter and chopped to a uniform texture, requiring approximately 3 minutes in the chopper. The chopped mixture was placed in a mechanical mixer, the powdered egg white added, and the material blended for a period of approximately 5 minutes. The prepared material was pressed into 1 oz. bars on a "Torque Punch Press", applying one punch of short duration at an estimated pressure of 1000 lbs. per square inch. The bars were mechanically wrapped and heat sealed in cellophane. Pasteurization was accomplished by immersing sealed 300 x 308 size cans, each containing 6 to 8 bars, in boiling water for 40 minutes at a temperature of 150-170° F. in the bars. Cans were then water cooled 30 minutes to 85° F. in bars.

NUTRITIONAL EVALUATION

Composition	Per 100 grams	Per Ounce	Ratio	Percent Calories
Total Solids	82.3	83.4		
Protein	12.1	3.4	1.0	12.0
Fat	15.5	4.4	1.3	35.0
Carbohydrate*	52.3	14.9	4.4	53.0
Ash	1.6	.5		
Crude fiber	.8	.2		
Calories	396	112.8		

* Other than crude fiber.

CHEESE AND CRACKER BAR

FD-11

FORMULA:

Ingredient	Percent*
Soda cracker	47.5
Cheese, dried	25.0
Whey, dried	10.0
Dextrin	10.0
Egg white, dried	7.5

PROCESSING:

The ingredients were blended in a Buffalo mixer, and compressed into bars at 2500 lbs. per square inch. These bars compressed easily, did not stick to the compression die, and could be wrapped rapidly and without difficulty.

* No reduction in weight due to processing.

NUTRITIONAL EVALUATION

Composition	Per 100 grams	Per Ounce	Ratio	Percent Calories
Total Solids	93.6	26.6		
Protein	21.7	6.2	1.0	19.4
Fat	17.1	4.8	.8	33.9
Carbohydrate*	52.4	14.9	2.4	46.7
Ash	2.3	.7		
Crude fiber	.1	.03		
Calories	450	127.6		

* Other than crude fiber.

PEANUT BUTTER - CRACKER BAR

FD-12

FORMULA:

Ingredient	Percent*
Soda cracker	47.5
Dextrin	10.0
Egg white, dried	7.5
Peanut butter	35.0

* No reduction in weight due to processing.

PROCESSING:

The ingredients were blended in a Buffalo mixer, and compressed into bars at 2500 lbs. per square inch. These bars compressed easily, did not stick to the compression die, and could be wrapped without difficulty.

NUTRITIONAL EVALUATION

Composition	Per 100 grams	Per Ounce	Ratio	Percent Calories
Total Solids	95.7	27.3		
Protein	19.9	5.7	1.0	16.8
Fat	21.3	6.1	1.1	40.4
Carbohydrate*	51.0	14.5	2.5	42.8
Ash	2.7	.8		
Crude fiber	.8	.2		
Calories	475	135.7		

* Other than crude fiber.

MODIFIED SWEETMEAT BAR

FD-13

FORMULA:

Ingredient	Percent*
Sugar	32.4
Vinegar	4.3
Milk fat	3.6
Cocoanut oil	1.8
Cottonseed oil	1.8
Whey, dried	3.6
Skim milk, dried	5.3
Cheese, proc. Am.	3.6
Peanut butter	17.8
Egg albumen, dried	8.9
Water	16.9

* 100 parts of original mix reduced to 87 parts during processing.

PROCESSING:

Water, sugar, and vinegar were mixed and heated in an open kettle over a gas flame. The mixture was cooked until syrup began to spin a thread or approximately 240° F. is reached. Milk fat, cocoanut oil, cottonseed oil, and processed cheese were creamed together. Whey and dried skim milk were mixed together thoroughly and added to the creamed fats, stirring until thoroughly mixed. Mixture was heated very slowly with continual stirring to prevent burning and brought to a boil. Boiling and stirring was continued until the semi-hard ball stage in cold water was reached. The peanut butter was creamed and blended with the egg albumen. Then the peanut butter - albumen mixture was beat into the previous batch after the latter had reached the semi-hard stage, and poured into a greased pan and allowed to set.

NUTRITIONAL EVALUATION

Composition	Per 100 grams	Per Ounce	Ratio	Percent Calories
Total Solids	95.5	27.3		
Protein	19.3	5.5	1.0	16.1
Fat	21.4	6.1	1.1	40.2
Carbohydrate*	52.1	14.9	2.7	43.7
Ash	2.3	.7		
Crude fiber	.4	.1		
Calories	480	136.5		

* Other than crude fiber.

PEANUT BUTTER - STRAWBERRY JAM

FD-14

FORMULA:

Ingredient	Percent*
Dextrin	13.2
Lactose	9.8
Egg white, dried	6.4
Peanut butter	29.9
Strawberry preserves**	29.9
Soda crackers	10.8

* No reduction in weight due to processing.

** 95% Total Solids.

PROCESSING:

Ingredients were thoroughly mixed and passed through a meat grinder, the size of the holes determining the size of strawberry particles in the final bar. The ground mixture was pressed into bars at 2500 lbs. per square inch.

NUTRITIONAL EVALUATION

Composition	Per 100 grams	Per Ounce	Ratio	Percent Calories
Total Solids	95.0	26.9		
Protein	14.0	4.0	1.0	12.5
Fat	15.4	4.4	1.1	31.0
Carbohydrate*	63.5	18.0	4.5	56.5
Ash	1.5	.4		
Crude fiber	.6	.1		
Calories	448	127.6		

* Other than crude fiber.

ALMOND BAR

FD-15

FORMULA:

Ingredient	Percent*
Almonds	41.9
Sugar	27.7
Chocolate	21.1
Egg white	9.3

* 100 parts of original mix reduced to 89 parts during processing.

PROCESSING:

Ingredients were mixed and chopped to a sufficiently fine consistency for pressing into bars, at 1000 lbs. per square inch. Some difficulty was encountered in pressing due to stickiness and crumbliness; but by scraping and cleaning the dies after pressing, satisfactorily compressed bars were obtained. Wrapping the bars in cellophane followed the pressing operation.

NUTRITIONAL EVALUATION

Composition	Per 100 grams	Per Ounce	Ratio	Percent Calories
Total Solids	99.7	28.2		
Protein	12.5	3.5	1.0	8.6
Fat	37.8	10.8	3.1	59.8
Carbohydrate*	45.3	12.9	3.7	31.6
Ash	2.1	.6		
Crude fiber	2.0	.4		
Calories	572	162.8		

* Other than crude fiber.

SWEET CHOCOLATE BAR

FD-16

FORMULA:

Ingredient	Percent*
Sugar	44.9
Cocoa butter	17.2
Skim milk, dry	15.7
Chocolate liquor	14.8
Egg albumen	7.4

* No reduction in weight due to processing.

PROCESSING:

Discs manufactured according to specification CQD 168 A and containing sugar, cocoa butter, skim milk, and chocolate liquor, were chopped very fine for pressing into bars. To each 100 grams of this powder was added 8 grams of egg albumen. In the compression of this bar, the high density of the ground material made the compression of a 1 oz. bar impossible. The feeding device on the press functioned under a volumeter principle which, when set at the minimum volume, still produced bars of 38-40 grams (approximately 1 1/4 oz. per bar). In view of the time required to make other mechanical adjustments to the press, the material was pressed at the above-mentioned weights and wrapped in cellophane.

NUTRITIONAL EVALUATION

Composition	Per 100 grams	Per Ounce	Ratio	Percent Calories
Total Solids	96.6	27.4		
Protein	13.5	3.8	1.0	10.6
Fat	25.2	7.2	1.9	45.0
Carbohydrate*	56.4	16.0	4.2	44.4
Ash	1.5	.4		
Crude fiber	.0	.0		
Calories	515	144.0		

* Other than crude fiber.